

HOW I DO IT

Useful Techniques for the Resection of Foot Melanomas

ROBERT A. COWLES, MD,¹ TIMOTHY M. JOHNSON, MD,² AND ALFRED E. CHANG, MD^{1*}

¹*Division of Surgical Oncology, University of Michigan Comprehensive Cancer Center, Ann Arbor, Michigan*

²*Department of Dermatology, University of Michigan, Ann Arbor, Michigan*

INTRODUCTION

The prevalence of melanoma is rapidly increasing [1,2] and therefore more patients are being evaluated by surgeons for treatment of this tumor. A main component of the treatment of primary melanoma involves wide local excision (WLE) of the primary lesion or of the biopsy scar with adequate margins [1–8]. Although this may seem to be a simple task on certain areas of the body, such as the back, chest, abdomen, and proximal extremity, it can prove difficult to do on the foot while still maintaining adequate function and providing coverage. Since acral (distal extremity) melanomas account for 4% to 35% [2–5,7,8] of all cutaneous malignant melanomas depending on the population, we present useful techniques which provide excellent functional results in treating these difficult lesions.

Because foot melanomas can be found on any surface of the foot, the foot should be thoroughly inspected as part of any skin examination. We have divided the foot into different anatomic regions as shown in Figure 1. Among the 2,439 cases of invasive melanomas compiled in a database established by the University of Michigan Multidisciplinary Melanoma Clinic, 63 (2.6%) were located on the foot (ankle lesions were excluded). The anatomic distribution and thickness of 57 of those cases are summarized in Table I (Breslow depth of the remaining 6 cases were unknown). As with other areas of the body, these lesions should undergo WLE with margins that are adequate for the histologic depth of the tumor. If the lesion is thin, and is located in a favorable location such as at the dorsum of the foot where there is some skin laxity, then a WLE and primary closure can be performed. However, acral lesions are generally thicker than lesions found elsewhere on the body [1,4]. Often, the alternate methods described below are required to obtain an optimal result.

MATERIALS AND METHODS

Toe Lesions

Toe lesions can occur in the subungual area [9,10] or skin overlying the digit and/or web space. Toe melanomas proved to be the thickest lesions in our experience (Table I), with the thickest being the subungual melanomas. For subungual and digital skin lesions, a ray amputation is appropriate for wide excision. Amputations of the great toe should always attempt to leave the metatarsal head intact in order to allow more even distribution of weight bearing, which results in better balance. This can be accomplished with a primary skin closure, but often necessitates creating a skin flap. Depending on the location of the lesion on the great toe (i.e., subungual or skin), a skin flap can be fashioned from the toe skin furthest away from the lesion in order to achieve coverage (Fig. 2). For the remaining digits, the ray amputation should entail removal of the metatarsal head in order to allow for tension-free primary skin closure and improved cosmesis (see case 4).

Lesions of the toe web space requires amputation of more than one digit. As illustrated in case 1 (Fig. 3), this 74-year-old woman presented with a melanoma of 2.6 mm in Breslow depth in the web spaces of the third and fourth toes, as well as the fourth and fifth toes. This necessitated amputation of the third, fourth, and fifth toes to include the metatarsal heads for closure. Postoperatively she maintains a normal gait and does not require any special shoe. At her last follow-up 3.5 years from her resection, she continues to remain free of disease. For these lesions, we recommend ray amputation of both dig-

*Correspondance to: Alfred E. Chang, MD, Division of Surgical Oncology, 3302 Cancer Center, 1500 E. Medical Center Drive, Ann Arbor, MI 48109. Fax No.: (734)647-9647.

E-mail: aechang@umich.edu

Accepted 14 January 1999

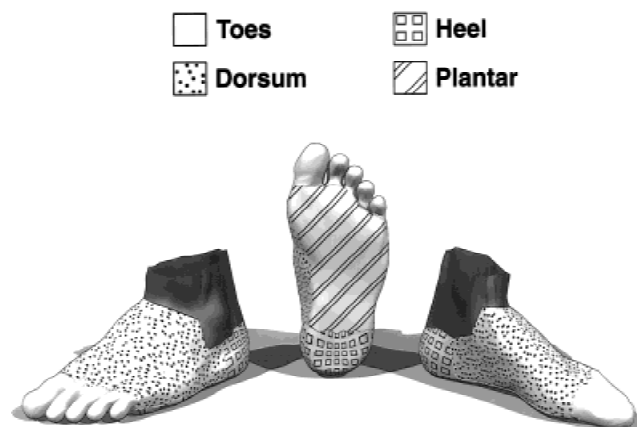


Fig. 1. Anatomical regions of the foot.

TABLE I. Distribution and Thickness of Foot Melanomas*

Site	Number (%)	Breslow depth (mm)	
		Median	Range
Toes	13 (23)	2.73	0.39–13
Plantar	20 (35)	2.37	0.45–10.0
Heel	9 (16)	1.46	0.43–5.39
Dorsum	15 (26)	1.27	0.38–7.11
Overall	57 (100)	1.76	0.38–13

*In situ melanomas have been excluded.

its flanking the lesion, which should include resection of the metatarsal heads to facilitate wound closure.

Plantar Lesions

Plantar lesions were the most common anatomic location of foot melanomas in our series and constituted 35% of cases. This has been corroborated by several other series [1,5,8,11]. They also tend to be thick lesions. In our experience they were second to toe lesions in thickness, with a median Breslow thickness of 2.37 mm. Generally these lesions present as broad-based lesions, which are not amenable to primary closure. Hence, these melanomas generally necessitate a wide excision that leaves a large surgical defect. We have avoided the use of tissue transfers to reconstruct these defects since it entails keeping the patient off their feet for extended periods of time. Rather, we have employed secondary wound healing techniques with delayed split thickness skin grafting (STSG) as a preferred method of management.

Case 2 is illustrative of the above. This patient is a 51-year-old male who presented with a nodular pigmented lesion in the midportion of his plantar region (Fig. 4). A punch biopsy confirmed an invasive melanoma at least >4 mm in thickness. He subsequently underwent wide excision with a 3-cm margin in all directions as well as a sentinel lymph node removal in the medial groin region. This was performed as an outpatient

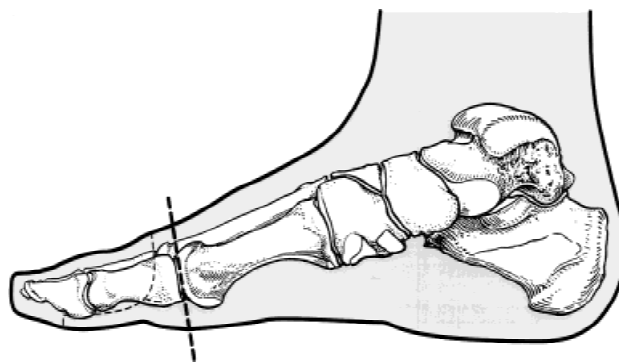


Fig. 2. Skin flap creation for a great toe amputation of the metatarsal-phalangeal joint. This approach is useful for subungual melanomas of the great toe.

procedure and he was sent home with instructions on how to pack the wound with saline wet-to-dry dressings. The pathology revealed a 10-mm nodular melanoma with negative margins and a positive sentinel node. Five weeks later, his foot defect had filled in with granulation tissue (Fig. 3) and he underwent an STSG along with a superficial groin dissection. He was found to have five additional positive nodes in his groin dissection specimen and went on to receive adjuvant interferon- α 2b therapy. We prefer to allow the initial surgical defect to granulate secondarily for several reasons. First, it is to allow final pathologic determination of the surgical margins. If the margins are close or positive, then a second procedure can be performed to obtain negative surgical margins. Second, this can be performed as an outpatient procedure and return the patient to weight-bearing as soon as possible. For smaller surgical defects, the wound can epithelialize secondarily without the need for grafting. Third, the bed of granulation tissue will fill in the soft-tissue defect, cover exposed tendons, and create a rich vascular recipient bed for a more successful take of the STSG. Additionally, allowing the wound to fill in with granulation tissue prior to STSG coverage prevents a permanent depressed contour abnormality and facilitates a better functional and cosmetic result. In our experience, application of an STSG at the time of a primary excision does not take as well in the plantar region, and the patient has to be non-weight-bearing on that foot for prolonged periods of time.

There are cases where plantar lesions can be fairly extensive. This is illustrated with case 3, which involves a 65-year-old man who presented with an extensive Breslow depth 2.78-mm melanoma of his right foot 4.5 years ago (Fig. 5). For these lesions, we recommend a transmetatarsal forefoot amputation. Since a significant amount of skin needs to be removed from the plantar surface, a long skin and subcutaneous flap needs to be created for closure. After this procedure, the patient has been able to ambulate with a customized shoe. Two years

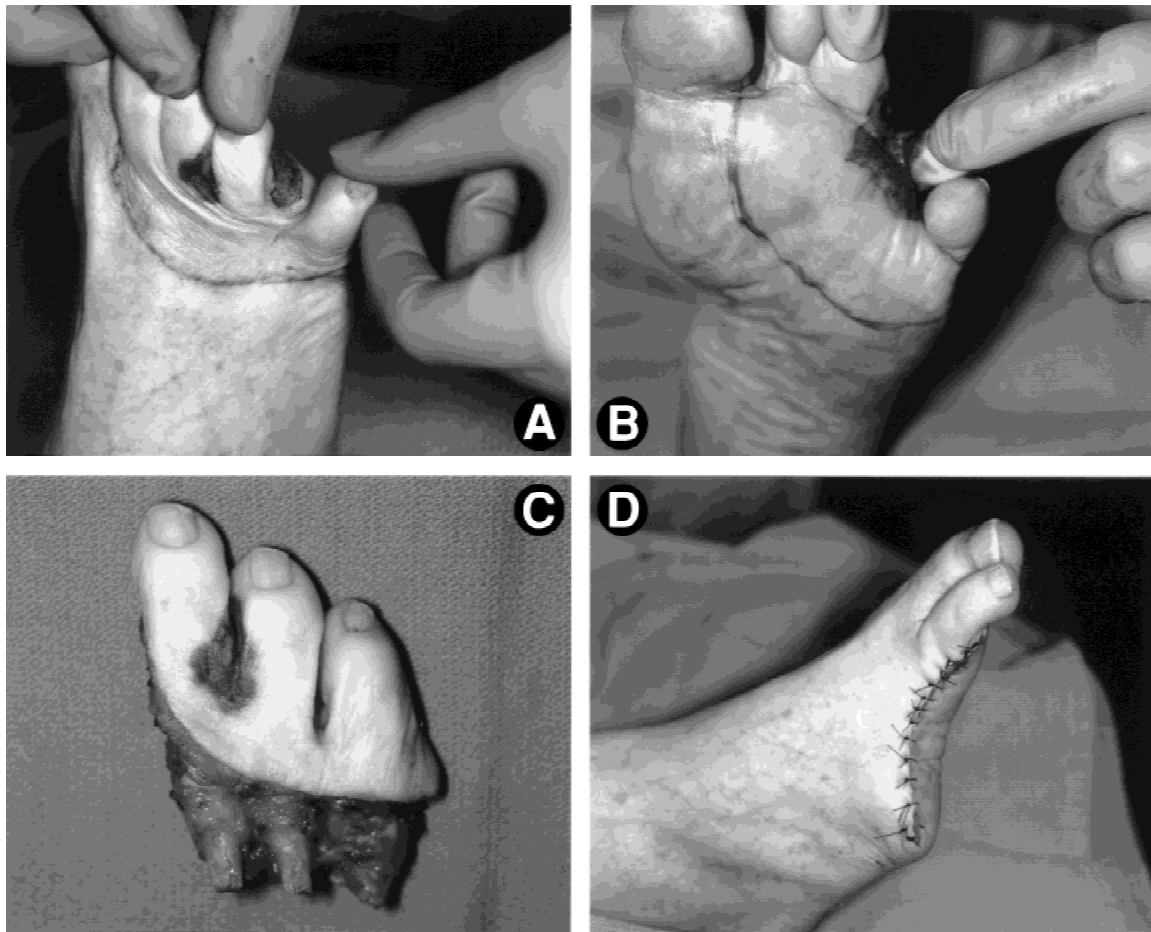


Fig. 3. Case 1: 79-year-old female with 2.73-mm melanoma involving the web spaces between the third, fourth, and fifth toes. (A and B) Preoperative appearance. (C) Resected specimen. (D) Postoperative appearance after primary closure.

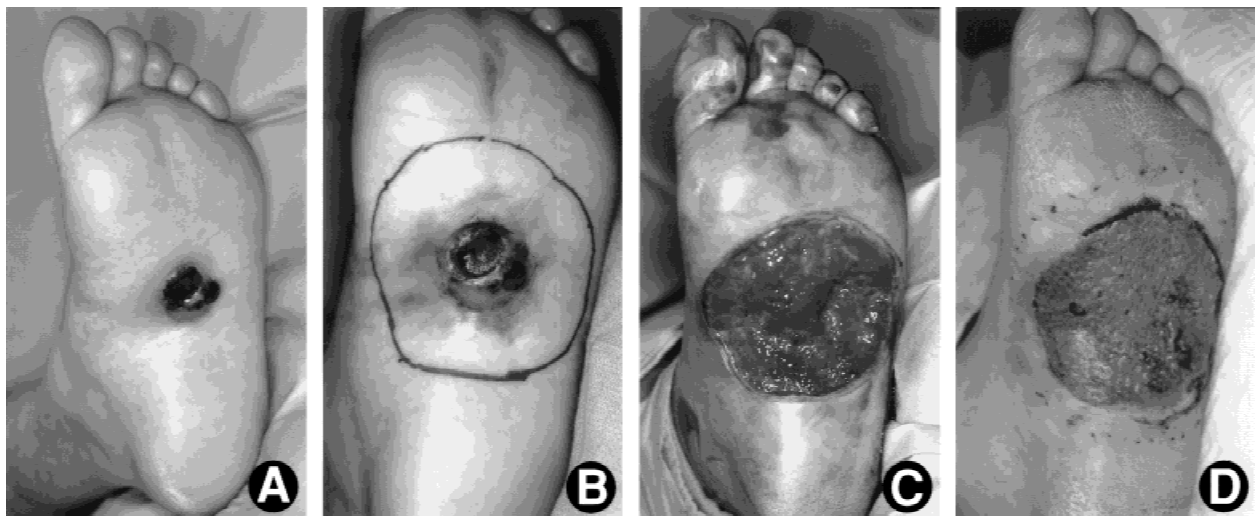


Fig. 4. Case 2: 51-year-old male with ulcerated 10-mm-thick melanoma of left plantar foot. (A) Preoperative appearance. (B) Injection of blue dye and planned margins of excision. (C) Wound filled in with granulation tissue 5 weeks after resection. (D) Appearance of delayed split thickness skin graft.

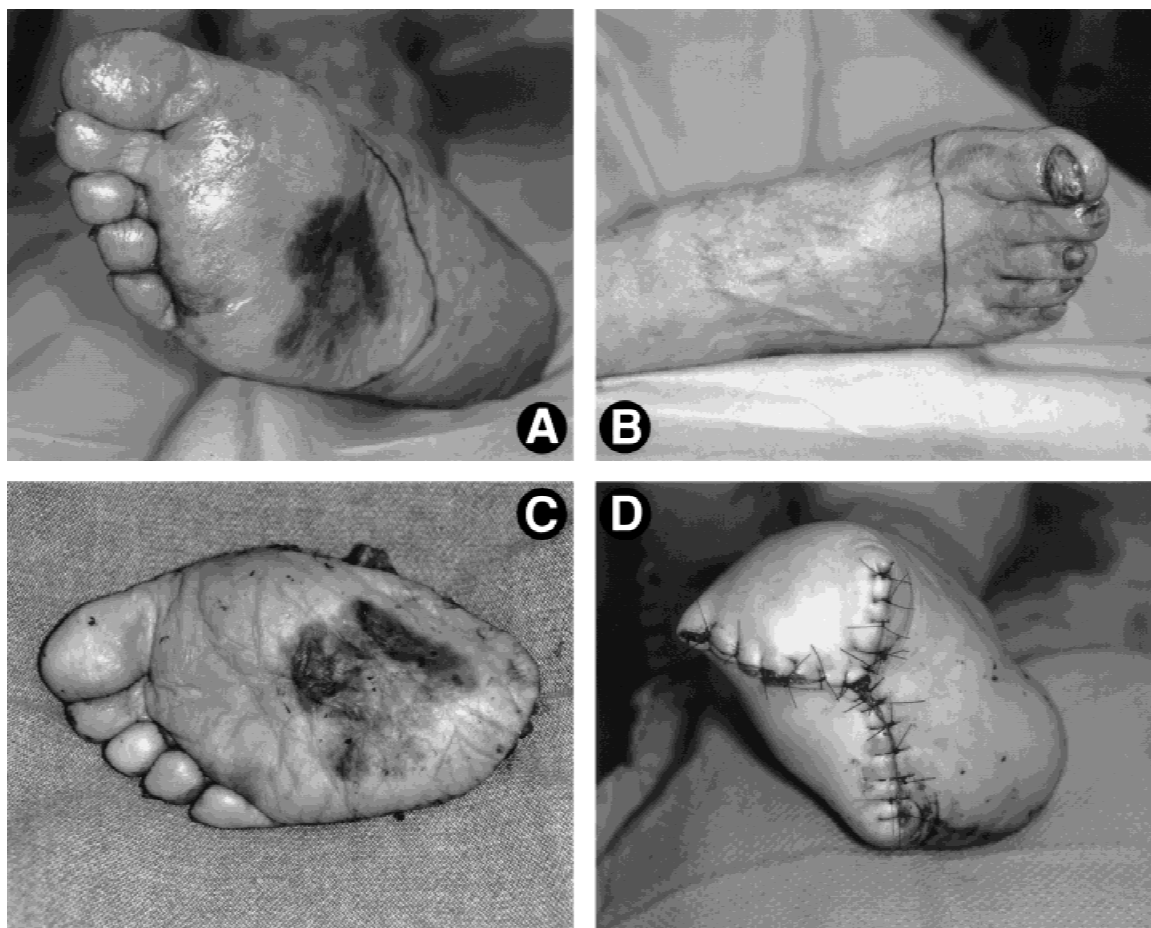


Fig. 5. Case 3: 65-year-old male with 2.27-mm-thick melanoma of right plantar foot. (A) Preoperative appearance. (B) Planned dorsal skin flap. (C) Operative specimen. (D) Postoperative primary closure.

after his forefoot amputation he developed regional disease in his groin and underwent a superficial groin dissection. Afterward, he received adjuvant interferon- α 2b and has been free of recurrence.

For plantar lesions close to the base of the toes, a WLE of plantar soft tissue may be required with a toe amputation. This is illustrated by case 4 (Fig. 6) involving a 50-year-old man who underwent an excisional biopsy of a 5-mm-thick melanoma with primary closure prior to being referred to the University of Michigan Comprehensive Cancer Center. The margins of excision were involved and the patient required a WLE. Due to the length and location of the prior biopsy incision a WLE to achieve a 3-cm margin was not deemed reasonable and would have necessitated sacrificing the second, third, and fourth toes. Hence a WLE to achieve a 1-cm soft-tissue margin and ray amputation of the third toe, which included the metatarsal head, was performed. The skin was closed on the dorsum of the foot and the soft-tissue defect on the plantar surface allowed to granulate secondarily. The wound epithelialized on its own approximately 4 weeks later. During that time, the patient was able to

weight-bear and ambulate. The pathology from the wide excision revealed no residual tumor.

Heel and Dorsum Lesions

Melanomas in these locations are less frequently seen (Table I). In our experience, they were also relatively thinner melanomas compared to the toe and plantar regions. For lesions on the plantar surface of the heel, the same concepts apply as described above. For lesions on the non-weight-bearing area of the heel and lesions on the dorsum, WLE with primary closure is sometimes feasible. If not, then delayed grafting as described above should be considered in order to establish a better recipient site for STSG application.

CONCLUSION

The foot represents an unusual site for melanomas. More than 50% of the patients present with lesions of the toes or plantar surface, which generally are thicker than melanomas found elsewhere. The primary objective in management is to achieve optimal local control. Along with this consideration, the functional results and early



Fig. 6. Case 4: 50-year-old male with 5-mm-thick melanoma of left plantar foot overlying third metatarsal head. (A) Preoperative appearance of prior biopsy site. (B) Postoperative appearance after wide local excision, secondary wound healing, and third ray amputation.

return to ambulation should be factored into the surgical approach for therapy. The use of secondary granulation healing followed by skin grafting in weight-bearing areas is associated with excellent functional outcomes.

ACKNOWLEDGMENTS

We thank Nisha Meireles for data management and Sally Smith for secretarial support in the preparation of this article. In addition, we acknowledge Matthew Quirk and Kurt Parfitt for their expertise in generating the illustration materials.

REFERENCES

- Fortin PT, Freiberg AA, Rees R, et al.: Malignant melanoma of the foot and ankle. *J Bone Joint Surg* 1995;77A:1396–1403.
- Tseng JF, Tanabe KK, Gadd MA, et al.: Surgical management of primary cutaneous melanomas of the hands and feet. *Ann Surg* 1997;225:544–553.
- Vijaykumar DK, Kanan RR, Chaturvedi HK: Plantar acral melanoma: An experience from a regional cancer centre, India. *Indian Cancer* 1996;33:122–129.
- Slingluff CL, Vollmer R, Seigler HF: Acral melanoma: A review of 185 patients with identification of prognostic variables. *Surg Oncol* 1990;45:91–98.
- Lin CS, Wang WJ, Wong CK: Acral melanoma: A clinicopathologic study of 28 patients. *Int Dermatol* 1990;29:107–112.
- Arons MS: The surgical treatment of cutaneous melanoma. *Yale Biol Med* 1975;48:417–422.
- Keyhani A: Comparison of clinical behavior of melanoma of the hands and feet. *Cancer* 1977;40:3168–3173.
- Petersen NC: Malignant melanoma of the foot. *Scand J Plast Reconstr Surg* 1968;2:144–153.
- Park KGM, Blessing K, Kernohan NM: Surgical aspects of subungual malignant melanomas. *Ann Surg* 1992;216:692–695.
- Finley RK, Driscoll DL, Blumenson LE, Karakousis CP: Subungual melanoma: An eighteen-year review. *Surgery* 1994;116:96–100.
- Coleman WP, Loria PR, Reed RJ: Acral lentiginous melanoma. *Arch Dermatol* 1980;116:773–776.

COMMENTARY

The article by Cowles et al. presents several useful techniques for the resection of foot melanomas. The practice more commonly used is to apply a skin graft to the area of the defect immediately after resection. However, as the authors noted, there is a high rate of failure to take for the graft, particularly when applied to the plantar surface of the foot. The technique suggested by the authors for delayed skin grafting after the wound has filled with granulation offers the advantages of a better cosmetic result and higher rates of graft take on an even surface, and therefore appears superior to the method of immediate skin grafting despite the inconvenience for the patient of waiting for a few weeks for the wound to granulate.

The technique presented in Figure 5 by Cowles et al., involving the amputation of the distal foot for an extensive plantar melanoma, is a useful one to have in mind

for extreme situations that are fortunately rare. For the majority of primary plantar melanomas, adequate lateral and deep margins can be obtained short of an amputation since one can dissect to the surface of plantar aponeurosis, and this aponeurosis can be resected as well as the first layer (short flexors) of muscles, if necessary, leaving a functionally intact foot as the experience with plantar sarcomas indicates.

Overall, the article provides an excellent elaboration of techniques involved in the surgical treatment of melanomas of the foot.

Constantine P. Karakousis, MD, PhD
CGF Health System
Millard Fillmore Hospital
Buffalo, New York 14209